

discussion of certain maximum and minimum properties leads to considerations of the changes which take place in an *ensemble* of system both when left to itself and when subjected to external influence, also of the results obtained by bringing two canonically distributed *ensembles* within influence of each other. The general conclusion is that there exist in statistical mechanics processes strictly analogous to many of those occurring in thermodynamics. Thus equations may be formulated closely resembling those which represent the irreversible heat-changes between two bodies of unequal temperature. When it comes to choosing a pair of conjugate variables to represent temperature and entropy, it is found that these are not uniquely determined, but that several systems are possible, a fact previously brought out, indeed, by von Helmholtz in his "Statics of Monocyclic Systems."

The last chapter deals with *ensembles* analogous to mixtures of different kinds of molecules, and these the author calls *grands ensembles*. They differ from the *petits ensembles* previously considered in the fact that they contain particles or systems of different kinds which may be present in different numbers.

Prof. Gibbs's work is not very easy to read, and it hardly seems appropriate to apply the title "elementary" to it; but the difficulties are no doubt inherent in the subject. It does much to elucidate the conditions under which a body composed of molecules obeying the equations of rational dynamics presents to beings of comparative dimensions similar to those of the human race attributes which may be summed up in the single word "temperature."

G. H. BRYAN.

AN ATTEMPT AT ORIGINALITY IN THE TEACHING OF ZOOLOGY.

A Course in Invertebrate Zoology. By Henry Sherring Pratt, Ph.D. Pp. xii + 210. (Boston, U.S.A., and London: Ginn and Co., the Athenæum Press, 1902.)

DR. PRATT'S book, defined on its title-page as a guide to the dissection and comparative study of invertebrate animals, is the latest of the many novelties which aim at effecting an improvement on the world-famous Huxleyean system, to which acknowledgment is made. The author sets out with the intention of enabling the student to study the larger groups as a whole, instead of detached types of different groups, as he claims is now generally done. In order to achieve this end, he deals in 174 pp. with no fewer than thirty-four representative animals, and the headlines of some of his chapters even bear the names of two alternative genera, for which a single description is made to suffice. Although this gives an average of little more than five pages for each animal, it must be admitted that, so far as they go, the descriptions and instructions, of necessity of a very elementary form, are lucid and correct.

Without going into further detail concerning the body of the book, it may be said that the essence of its novelty lies rather in the appendix and its associated classificatory scheme. This leads off with a copy of Claus's 1887 system, in which, as an all-conspicuous

feature, the Sponges were classed as Coelenterates, the Enteropneusta as Echinoderms. Then follows a short, but with a useful, historical sketch of the growth of classificatory systems, from Cuvier to Hatschek, whose scheme of 1888 is given in tabular form, with a succeeding list of "short definitions" which are supposed to be *en suite*, and of which it is remarked that while not exhaustive they "are intended but simply to characterise the various groups in the fewest possible words." The first great subdivision is into subkingdoms (Protozoa and Metazoa), divisions follow, then types, classes, and orders. When, however, on comparison, one finds that while the table provides for five types (Spongiaria, Cnidaria, Trochozoa, Echinodermata, and Chordata), the three first-named are for the definitions numbered in order, and the two last-named are numbered five and six, one is led to seek for number four. The search is vain, since table and definitions do not agree. Most of the descriptions, moreover, in their would-be conciseness, are inadequate. And when with this it is said that, under type Trochozoa, defined as "Metagastrozoans whose common descent and relationship are shown by their possession in some form of a trochophore larva or of an embryonic form allied to it," there are included as subtypes Vermes, Articulata, and Mollusca, further comment becomes unnecessary, except to give it as our opinion that whatever the future of the zoological training of the young, it will not develop on these lines.

The above analysis might be extended with even humorous results; but whatever the good points the book may possess, failure appears to us certain in the attempt to do too much. The would-be new departure is foreign to the best traditions of the Huxleyean system. In the later development of this, the thorough mastery of type-structure has come to be regarded as an alphabet, by which the student learns to read, and the broadest possible survey of the structural limitations of the several groups of which the types are members, as a reading lesson to follow, under the special guidance of the teacher.

OUR BOOK SHELF.

Slide Rule Notes. By Lieut.-Colonel H. C. Dunlop, R.F.A., Professor of Artillery at the Ordnance College, and C. S. Jackson, M.A. (Barrister-at-Law), Instructor in Mathematics R.M. Academy, late Scholar Trinity College, Cambridge. Pp. 66. (London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd., 1901.)

THE slide rule is one of those things which can be less readily explained in writing than verbally. A few words explaining the principle so as to develop the slide rule sense is all that is required to put anyone of reasonable quickness in the way of becoming an adept. On the other hand, the full exposition of the logarithmic theory of the mode of setting for each class of operation, which is essential where the art is to be taught from a book, makes the thing seem so complicated and difficult to remember, that many who would find no difficulty in being taught by the first method might well give it up in despair at the very outset when taught only by the second method. However, it is not given to everyone to be able to find an adept with a power of exposition, and so the book becomes a necessity.

In the writer's opinion, the introductory chapter on the properties of logarithms does not furnish the most practical method, though of course it is eminently scientific, of showing the way to the use of the slide rule. But given that it is to be taught as school subjects are taught, *i.e.* so that the learner cannot see what the object is until he has arrived there, there is nothing but commendation for these notes, as they are called. Many as the books are on the slide rule, the writer of this notice has never seen one so complete and so logical. In addition to the regular uses which are always explained, though many who are familiar with the A, B, C and D lines fight shy of the trigonometrical lines, the solution of quadratic and cubic equations, exponentials and the plotting of curves are illustrated by many examples. Dr. Roget's log. log. line is shortly described, but no reference is made to Lanchester's radial cursor, which makes thermodynamical calculations with γ -wise exponents almost as direct as plain multiplications, and far more convenient than with the log. log. line.

One unfortunate misprint occurs near the beginning, where the construction of the rule is being explained, and the distance from 1 to 2 or log 2 is stated to be 3.03 instead of 3.01. C. V. B.

Injurious and Useful Insects: an Introduction to the Study of Economic Entomology. By L. C. Miall, F.R.S. Pp. viii+256. (London: George Bell and Sons, 1902.) Price 3s. 6d.

THIS little book is unfortunate in its title. One would expect to find all its pages given up to economic entomology; instead we find much valuable space taken up with long accounts of a carnivorous water beetle (*Dytiscus marginalis*), pp. 32 to 37; the tiger moth (*Arctia caja*), pp. 58 to 62; the harlequin fly (*Chironomus*), pp. 100 to 125. What such subjects have to do with economic entomology it is difficult to understand. At the same time, some interesting accounts of various economic species and groups are given, such, for instance, as the cockchafer, wireworm, turnip-flea, the gooseberry saw-fly, the hive bee, the silkworm, aphides and scale insects, &c. The accounts of the life-histories of these are all interestingly and accurately compiled, but when the practical part comes the work fails; compilation mainly from foreign sources, unless backed up by practical experience of such matters, is usually fatal.

For instance, no mention is made of trapping the adult click-beetles, the parents of the ravenous wireworm, yet it is the only way any good is done; nor is the practice of growing a crop of mustard on wirewormy land mentioned, and what is the use of advising the American remedy for the ground form of woolly aphid—tobacco-dust dug into the soil—in this country? The work is divided into four parts, dealing with the following subjects:—Part i., preliminary lessons, giving an excellent account of the structure of an insect; part ii., lessons on common insects, chiefly such as are either useful or injurious to man.

Part iii. deals with classification, and gives a concise outline of the different groups of insects; this is the most useful portion of the book. The names given to a good many insects in this part are, however, unfortunately not quite accurate; for instance, on p. 192 all the aphides, *rosae*, *humuli*, *mali*, &c., are put as belonging to the genus *Aphis*, which is not the case; nor is the name of the diamond-back moth *Plutella cruciferarum*, nor is that of the wheat midge *Cecidomyia tritici*; there may be an excuse for specific names being inaccurate, but surely not for generic ones.

Part iv. deals with the destruction and mitigation of insect pests; this is mainly compiled from American sources, the writer evidently being unacquainted with any work done in this country. Certainly here no one

would dream of following the advice given on p. 246, "Paris green may be applied without danger at the strength of 1 lb. to 150 gallons of water." No mention is made of quassia wash or caustic alkali wash, so largely used in this country. The whole chapter is, in fact, but a poor account of the subject.

The work is illustrated with 103 figures, the majority good, but the reproductions of Bracy Clarke's bot-flies (Figs. 81 and 82) are scarcely recognisable; nor would anyone recognise the larva of the gooseberry saw-fly (Fig. 56), or the goat moth and its larva (Figs. 48 and 49).

To the pure entomologist the work will prove interesting and instructive reading, but it cannot be recommended to those who wish to study the economic side of the subject.

Chloroform: a Manual for Students and Practitioners. By Edward Lawrie, Lieut.-Colonel I.M.S., &c. Pp. 120. (London: J. and A. Churchill, 1901.) Price 5s. net.

THE book before us will be read with interest by those in whose memory the chloroform polemic is still green. It consists essentially of a physiological and clinical part. With regard to the former, Dr. Lawrie gives a history of the polemic between Drs. Gaskell and Shore and himself, extending from the first publication of the Cambridge physiologists upon this subject to the discussion at Toronto in 1894, in which, in the author's words, "the victory, which was decisive and permanent, rested with us." In addition to this historical sketch, the author gives certain experiments from the report of the Hyderabad Commission, some experiments made subsequently at Hyderabad, and some made by Prof. Rutherford upon the effect of stimulation of the vagus nerve during the inhalation of chloroform. These experiments are all illustrative of the action of chloroform upon the circulation, and are adduced by the author in support of the thesis that chloroform has no direct paralysing action upon the heart. The rest of the book is devoted mainly to the clinical aspect of the subject, the author entering fully into the technique of chloroform administration. Here he maintains strongly that the entire attention of the anaesthetist should be devoted to the respiration, and that no chloroform should be administered during struggling. The last chapter is devoted to the question of the statistics of chloroform and ether administrations. The author's statistics of chloroform show one death in 17,300 administrations; those of Mr. Roger Williams one death in 1236 chloroform and one in 4860 ether administrations.

Les Limites de la Biologie. Par J. Grasset. Pp. iv + 188. (Paris: Felix Alcan.) Price 2f. 50c.

PROF. GRASSET'S book is based upon a lecture he delivered at Marseilles in April of last year; we have here, however, not only the substance of that discourse, but numerous extracts from the writings of philosophers and men of science of many countries in support of the author's thesis. It is urged that biology is not the universal and unique science which some of its exponents claim it to be; and an attempt is made to describe its limitations. In separate chapters of his book, M. Grasset considers biology in its relation to the physicochemical sciences, to morality, psychology, aesthetics, sociology, mathematics, logic, metaphysics and theology. Whether the reader agrees with the conclusions or not, he will be interested in this exposition of the views of a medical man who believes there are parallel lines of progress along which human knowledge will continue to grow, and that these lines cannot from the nature of things intersect.